AMENDMENTS TO THE CLAIMS

Please amend the claims as follows.

1. (Previously Presented) A multi-channel laser interferometric method for measuring the displacement of a surface of a material subjected to ultrasound, which comprises:

    generating a laser beam having a predetermined intensity;

    dividing the laser beam into a reference beam and a probe beam having respective intensities representing minor and major fractions of the predetermined intensity;

    passing the probe beam through an optical lens to focalize the probe beam onto the surface of the material subjected to ultrasound, thereby scattering same;

    expanding the reference beam;

    combining the scattered probe beam collected by said optical lens with said expanded reference beam to obtain an optical fringe signal;

    receiving said optical fringe signal on at least one array of photodetectors, wherein said optical fringe signal fully covers said array and each photodetector of the array defines a channel, having a given aperture smaller than the aperture of said optical lens to receive a portion of said optical fringe signal and converting said portion of said optical fringe signal into an electrical signal;

    processing for each channel said electrical signals through circuitry means;

    summing electrically said processed signals to extract an output signal correlated to the motion of said surface.

2. (Previously Presented) A method according to claim 1, wherein processing comprises first filtering said signals, then squaring said filtered signals.

3. (Previously Presented) A method according to claim 1, wherein processing comprises first filtering said signals, then rectifying said filtered signals.

4. (Previously Presented) A method according to claim 1, wherein it further comprises:

linearly polarizing the scattered probe beam collected by the optical lens, circularly
polarizing the expanded reference beam;

combining the linearly polarized scattered probe beam with the circularly polarized
expanded reference beam to obtain two optical fringe signals having a phase shift of
90[deg.];

receiving the first and second optical fringe signals on two arrays of detectors, the two arrays
of detectors being identical, two detectors of the corresponding channels of the arrays
generating two in-quadrature electrical signals, the electrical signal pairs being then
processed together through said circuitry means.

5. (Previously Presented) A method according to claim 4, wherein the step of processing
comprises:

first dividing and filtering said in-quadrature signal pairs to separate each signal into a high-
frequency signal and a low-frequency signal, then for each signal pair,

Generating two signals by cross-multiplication between the said low-frequency signal pair
and the said high-frequency signal pair,

differentiating the said two signals.

6. (Previously Presented) A method according to claim 4, wherein the step of processing
comprises:

first dividing and processing said in-quadrature signal pairs to separate each signal into the
original signal and its derivative signal, then for each signal pair,

Generating two signals by cross-multiplication between the said original signal pair and the
said derivative signal pair,

differentiating the said two signals.

7. (Previously Presented) A method according to claim 4, wherein the step of processing
comprises:

first high-pass filtering said signal pairs, then for each signal pair,

summing the two signals obtained by squaring of each signal of the signal pair.

8. (Previously Presented) A method according to claim 4, wherein the step of processing comprises:

    first high-pass filtering said signal pairs, then for each signal pair,

    summing the two signals obtained by rectification of each signal of the signal pair.

9. (Previously Presented) A method as claimed in claim 1, wherein said scattered probe beam and said expanded reference beam having crossed polarization, it further comprises dividing each of the scattered probe beam and the expanded reference beam in two optical signals having a 180[deg.] phase difference, the combining of the optical signals resulting in four optical fringe signals having -90[deg.], 0[deg.], 90[deg.] and 180[deg.] relative phase differences; and wherein the step of receiving further comprises:

    receiving the four optical fringe signals on four arrays of detectors, the four arrays of detectors being identical, each set of four detectors of a corresponding channel generating two in-quadrature pairs of out-of-phase electrical signals,

    subtracting each said out-of-phase electrical signals to obtain a pair of differential in-quadrature electrical signals for each said channel, said pairs of differential in-quadrature electrical signals being processed together through said circuitry means.

10. (Previously Presented) A method as claimed in claim 1, wherein it further comprises:

    frequency shifting said reference beam, the optical fringe signal resulting from combining said scattered probe beam with said expanded shifted reference beam being an heterodyne optical fringe signal, and

    the step of processing comprising demodulating each electrical signal for each channel by removing the frequency shift using heterodyne demodulation techniques.

11. (Previously Presented) A multi-channel laser interferometric apparatus for measuring the motion of a surface of a material subjected to ultrasound, which comprises:

    a laser source for generating a laser beam having a predetermined intensity;

a beam splitter for dividing said laser beam into a reference beam and a probe beam having respective intensities representing minor and major fractions of said predetermined intensity;

an optical lens disposed for focalizing said probe beam onto the surface of said material subjected to ultrasound, thereby scattering same;

a beam expander expanding said reference beam;

combining means for combining the scattered probe beam with said expanded reference beam to obtain an optical fringe signal;

receiving means with at least one array of detectors for receiving said optical fringe signal on, wherein the optical fringe signal fully covers the array, and each detector, defining a channel, has a given aperture smaller than the aperture of said optical lens to receive a portion of said optical fringe signal and convert said portion of said optical fringe signal into an electrical signal;

circuitry means for processing for each channel said electrical signals and summing said processed signals to extract an output signal correlated to motion of the surface.

12. (Previously Presented) An apparatus according to claim 11, wherein circuitry means comprise filtering means for filtering the electrical signals and squaring means for squaring the filtered signals.

13. (Previously Presented) An apparatus according to claim 11, wherein circuitry means comprise filtering means for filtering the electrical signals and rectifying means for rectifying the filtered signals.

14. (Previously Presented) An apparatus according to claim 11 further comprising polarizing means for circularly polarizing the expanded reference beam, wherein:

the combining means comprise a polarizing beam splitter for combining the linearly polarized scattered probe beam with the expanded circularly polarized reference beam to obtain two optical fringe signals having a phase shift of 90[deg.];

the receiving means comprise two identical arrays of detectors for receiving the optical fringe signals on, the two detectors of a same channel of each array generating a pair of in-quadrature electrical signals, the pairs of in-quadrature electrical signals being then processed together by the circuitry means.

15. (Previously Presented) An apparatus according to claim 11, wherein it further comprises:

polarizing means for setting the polarization of the expanded reference beam orthogonal to the polarization of the probe beam;

dividing means to divide each of the polarized scattered probe beam and the expanded orthogonally polarized reference beam into a first and a second signals;

an optical retardation device in one of the first or second optical signals to obtain a phase shift of 90[deg.] between the first and second optical signals; and wherein:

the combining means comprise two polarized beam splitters for combining the two orthogonally polarized components of the first and second optical signals, each into two optical fringe signals having a 180[deg.] phase difference; resulting in four optical fringe signals having -90[deg.], 0[deg.], 90[deg.] and 180[deg.] relative phase differences;

the receiving means comprise four identical arrays of detectors for receiving the four optical fringe signals, each set of four detectors of a corresponding channel generating two pairs of out-of-phase electrical signals,

the circuitry means further comprise subtracting means for subtracting each of the out-of-phase electrical signals to obtain a pair of differential in-quadrature electrical signals for each said channel, the pairs of differential in-quadrature electrical signals being then processed together.

16. (Previously Presented) A multi-channel laser heterodyne interferometric apparatus according to claim 11, wherein it further comprises a frequency shifting device for frequency shifting the reference beam by a given frequency, the frequency shifted reference being then expended, and wherein:

the combining means combine the scattered probe beam with the expanded frequency shifted reference beam to obtain an heterodyne optical fringe signal, the heterodyne optical fringe signal being received by the receiving means;

the circuitry means comprise demodulation means for processing for each channel the heterodyne electrical signals through demodulation by removing the frequency shift using standard heterodyne demodulation techniques, the output signal obtained by summing the processed signals being proportional to the displacement of the surface.

17. (Previously Presented) An apparatus according to claim 11, wherein the array of detectors is a linear array of detectors.

18. (Previously Presented) An apparatus according to claim 11, wherein the array of detectors is a two-dimensional array of detectors

19. (Previously Presented) A multi-channel fiberized laser interferometric apparatus according to claim 11, wherein it further comprises a multi-mode optical fiber and coupling means for coupling the laser beam into the optical fiber, and wherein:

a partially reflecting coating at the optical fiber end enables dividing the laser beam into the reference beam and the probe beam;

the optical lens for focalizing the probe beam onto the surface of the material is disposed at the end of the optical fiber, and refocuses the scattered probe beam into the optical fiber;

the receiving means comprise at least one two-dimensional array of detectors and a second optical lens for focusing on the array of detectors the multi-mode optical beam exiting though the entrance face of the multi-mode fiber and corresponding to the mixing between the scattered beam and the partially reflected beam.

20. (New) A laser interferometric apparatus for measuring a displacement of an object, the apparatus comprising:

    a laser source for producing a laser beam having a given intensity;

    a beam splitter for dividing the laser beam into a reference beam and an object beam to be directed to the object, thereby producing a scattered object beam being modulated according to the displacement of the object;

    a beam combiner for combining the scattered object beam and the reference beam to provide at least one interference beam;

    at least one array of detectors for receiving the at least one interference beam, each detector of the array receiving a portion of the at least one interference beam to form an electrical interference signal, the electrical interference signal comprising a wanted signal component indicative of the object displacement and a substantially equal intensity noise component; and

    a processing circuit comprising a differential amplifier for subtracting at least two electrical interference signals formed by at least two portions of the interference beam, thereby generating a displacement signal, the displacement signal comprising substantially the wanted signal component alone, wherein the intensity noise is substantially rejected.

21. (New) A method for measuring a displacement of an object, the method comprising:

generating a laser beam having a given intensity;

dividing the laser beam into a reference beam and an object beam to be directed to the object, thereby producing a scattered object beam being modulated according to the displacement of the object;

combining the scattered object beam and the reference beam to provide at least one interference beam;

receiving the at least one interference beam with at least one array of detectors, each detector array receiving a portion of the at least one interference beam to form an electrical interference signal, the electrical interference signal comprising a wanted signal component indicative of the object displacement and a substantially equal intensity noise component; and

processing at least two electrical interference signals formed by at least two portions of the interference beam, the processing comprising subtracting the at least two electrical interference signals, thereby generating an output signal, the output signal comprising substantially the wanted signal component alone, wherein the intensity noise is substantially rejected.